ARST 2.2.1.1

To: **Ann Daily, Don Heinle**
From: **Matt Kadlec**
Subject: **Spokane River Environmental Data Search Results**
Date: **December 16, 1999**
Cc: **John Roland, Fred Kirchner**

The results of my Spokane River environmental data search are as follows. For convenience, these data sources are listed in separate categories (biological community data, tissue metal concentrations, sediment data, water quality data, and habitat assessment data), along with the reach or reaches involved. Some of these reports are not among the documents on the CH2MHill/URS Greiner "Electronic Document Reference Library for the Coeur d' Alene Basin RI/FS". Upon request, I will provide those you still require. substantial metals contamination within the wetted width of the Spokane at many point along its length does not preclude the chance of contamination in floodplain and upland or areas: However, I did not find any information metals in any media beyond the river itself. Please distribute this memorandum as appropriate.

Ecological Data

Fisheries Assessments

Gibbons et al. 1984 -- Upper Spokane River
Pfeiffer 1985 -- Lower Spokane River
Kleist 1987 -- Lower Spokane River
Bennett and Underwood 1988 -- Upper Spokane (in Idaho)
Johnson 1997 -- Upper Spokane River

Invertebrate Assessments

Gibbons et al. 1984 -- Upper Spokane River
Pfeiffer 1985 -- Lower Spokane River
Kleist 1987 -- Lower Spokane River

Periphyton Assessment

Gibbons et al. 1984 -- Upper Spokane River

Plankton Assessments

Gibbons et al. 1984 -- Upper Spokane River
Pfeiffer 1985 -- Lower Spokane River
Kleist 1987 -- Lower Spokane River

Special Status Species and Sensitive Habitats

Gamon 1999 -- Spokane River (Appendix 1)
Robinette 1999 -- Spokane River (Appendix 2)

Tissue Metal Concentrations

Biofilm

Farag, et al. 1998. – Upper Spokane River

Fish

Bailey and Saltes 1982 – Upper Spokane River
Saltes and Bailey 1984 – Upper Spokane River
Bailey and Singleton 1984 – Upriver dam
Beckman et al. 1985 – Spokane Arm
Hopkins et al. 1985 – Nine Mile Dam and Up River Dam
Johnson et al. 1988 -- Lake Roosevelt
Johnson et al. 1990 – Spokane Arm
Serdar et al. 1994 – Long Lake
Johnson 1994 -- Idaho to Spokane Arm
Munn et al.1995. -- Lake Roosevelt
Farag et al. 1998. – Upper Spokane River

Invertebrates

Funk et al. 1973 – Upper Spokane River
Moore et al. 1996 – Upper Spokane River
Farag et al. 1998 – Upper Spokane River

Periphyton

Farag et al. 1998. – Upper Spokane River (in Idaho)

Phytoplankton

Funk et al. 1973 – Upper Spokane River

Sediments

Metal Concentrations

Beckman et al. 1985 – Spokane Arm
Johnson et al. 1988 -- Lake Roosevelt
Johnson et al. 1990 – Spokane Arm
Johnson 1991 – Lake Roosevelt
Serdar et al. 1994 – Long Lake
Bortleson et al. 1994. -- Spokane Arm, Long Lake
Moore et al. 1996 – Upper Spokane River
Farag et al. 1998. – Upper Spokane River (in Idaho)
USGS/WDOE (Appendix 3) --10 sites along main stem

Grain-Size Proportion < 63-um

USGS/WDOE (Appendix 3) --10 sites along main stem

Substrate Description (Embeddedness)

Falter and Mitchell 1982 - Upper Spokane (in Idaho)
Pfeiffer 1985 -- Lower Spokane River
Kleist 1987 -- Lower Spokane River
Bennett and Underwood 1988 -- Upper Spokane (in Idaho)
Johnson 1997 -- Upper Spokane River

Water Quality Data

Zinc, Lead, Cadmium, etc.

Yearsley 1980, 1981 -- Upper Spokane River & Idaho
Bailey and Saltes 1982 – Upper Spokane River
Funk et al. 1983 -- Upper Spokane River to State
Gibbons et al. 1984 --Upper Spokane River
Bailey and Singleton 1984 – Upriver dam
Beckman et al. 1985 – Spokane Arm
Reif 1986 – Upriver dam
Johnson et al. 1988 -- Lake Roosevelt
Chern 1989 – Upriver dam
Johnson et al. 1990 – Spokane Arm
Johnson 1991 – Lake Roosevelt
Hallinan et al. 1991 -- Upriver dam
Joy 1992 – Upriver dam
Stinson 1993 – Upper Spokane River
Zheng 1995 – Upper Spokane River
Pelletier 1996 -- RM-63.5, 64.5, 85.3, 96
Wiggins et al. 1996 – Upper Spokane River
Hopkins and Johnson 1997 – Idaho, Long Lake
WDOE-AMS 1994-1997 – State line and Riverside Park
Farag, et al. 1998. – Upper Spokane River (in Idaho)
USGS WATSTORE 1998 -- Long Lake to upper river, 6 sites

Nutrients

Gibbons et al. 1984 -- Upper Spokane River
WDOE-AMS 1994-1997-- Spokane River
USGS 1998 (WATSTORE) -- Long Lake to upper river, 6 sites

Dissolved Oxygen

Gibbons et al. 1984 -- Upper Spokane River
Pelletier 1995 -- RM-72.8, 77.5, 80.6, 81.9, 82.9, 83.5
WDOE-AMS 1994-1997-- Spokane River

Temperature

Gibbons et al. 1984 -- Upper Spokane River
Kleist 1987 -- Lower Spokane River
Pelletier ca. 1995a -- RM-63.5, 64.5, 85.3, 96
Pelletier ca. 1995b -- RM-72.8, 77.5, 80.6, 81.9, 82.9, 83.5
Johnson 1997 -- Upper Spokane River
WDOE-AMS 1994-1997-- Spokane River

USGS 1998 (WATSTORE) -- Long Lake to upper river, 6 sites

pH

Pelletier 1994 -- RM-63.5, 64.5, 85.3, 96
Pelletier 1995 -- RM-72.8, 77.5, 80.6, 81.9, 82.9, 83.5
WDOE-AMS 1994-1997 Spokane River
USGS 1998 -- Long Lake to upper river, 6 sites

Solids

Gibbons et al. 1984 -- Upper Spokane River
Pelletier 1995 -- RM-63.5, 64.5, 85.3, 96
WDOE-AMS 1994-1997 Spokane River

Turbidity

WDOE-AMS 1994-1997 Spokane River

Habitat Data (Riparian area, or channel morphology-pool/riffle ratio, or flow, etc.)

Kleist 1987 --Lower Spokane River
Bennett and Underwood 1988 - Upper Spokane (in Idaho)
Johnson 1997 -- Upper Spokane River
USGS 1998 (WATSTORE) -- Long Lake to upper river, 6 sites

Complete Citations

G.C. Bailey and J. Saltes. 1982. The Development of Some Metals Criteria for the Protection of Spokane River Rainbow Trout . Project Completion report to: Washington State Dept. Ecology. Washington State Univ., Pullman.

G. Bailey and L. Singleton. 1984. Spokane Industrial Park Receiving Water Survey. Memorandum to R. Ray. Washington State Dept. Ecology, Olympia.

L. Beckman, J. Novotny, W. Persons, and T. Terell. 1985. Assessment of the Fisheries and Limnology of Lake F.D. Roosevelt., 1980-83. Prep. for U.S. Bureau Reclamation. U.S. Fish and Wildlife Service. FW-14-06-009-904.

David Bennett and Tevis Underwood. 1988. Population dynamics and factors affecting rainbow trout (*Salmo gairdneri*) in the Spokane River, Idaho. Dept. of fish and Wildlife Resources College, University of Idaho Completion Report #3. Washington Water Power.

G. Bortleson, S. Cox, M. Munn, R. Schumaker, E. Block, L. Bucy, and R. Cornelius. 1994. Sediment-Quality Assessment of Franklin D. Roosevelt Lake and the Upstream Reach of the Columbia River, Washington, 1992. USGS Open File Rept. 94-315.

L. Chern. 1989. Reconnaissance Survey of the Impacts of Northside Landfill Leachate on Ground/Surface Water Quality, Spokane, Washington. Washington State Dept. Ecology. Olympia.

Michael Falter and Bradley Mitchell. 1982. Aquatic Ecology of the Spokane River Between Coeur d'Alene and Post Falls, Idaho 1980 Dept. of Fisheries Resources, College of Forestry, Wildlife, and Range Sciences University of Idaho, Moscow. Idaho Dept. of Health, Boise.

W. Funk, F. Rabe, R. Filby, P. Dunigan, N. Thompson, R. Condit, P. Bennett, K. Shah, 1973. The Biological Impact of Combined Metallic and Organic Pollution in the Coeur d'Alene--Spokane River Drainage System

A. Farag, D. Woodward, J. Goldstein, W. Brumbaugh and J. Meyer. 1998. Concentrations of metals associated with mining waste in sediments, biofilm, benthic macroinvertebrates, and fish from the Coeur d'Alene River basin, Idaho. Archives of Environmental Contamination and Toxicology 34:119-127.

W. Funk, H. Gibbons, R. Duffner, T. Notestine, and T. Nielsen. 1983. Water Quality of the Upper Spokane River and Evaluation of Methods for Measurement of the Effect of Effluent upon Primary and Secondary Producers. State of Washington. Water Research Center, Pullman. Rep. 48.

H. Gibbons, W. Funk, R. Duffner, T. Nielsen, and T. Notestine. 1984. Baseline Study to Determine the Water Quality and the Primary and Secondary Producers of the Spokane River, Phase I. Joint project completion report to: Washington State Dept. Ecology. State of Washington, Water Research Center, Pullman. Report 57.

P. Hallinan, T. Nell, and N. Glenn. 1991. Kaiser Aluminum and Chemical Corp., Trentwood Class II Inspection. Washington State Dept. Ecology, Olympia.

B. Hopkins, D. Clark, M. Schlender. and M. Stinson. 1985. Fish Tissue and Sediment Sampling for 1984. Washington State Dept. Ecology. Olympia. Pub. No. 85-7.

B. Hopkins and A. Johnson. 1997. Metal Concentrations in the Spokane River during Spring 1997. Memorandum to J. Manning and C. Nuechterlein. Washington State Dept. Ecology, Olympia.

A. Johnson, D. Norton, and B. Yake. 1988. An Assessment of Metals Contamination of Lake Roosevelt. Washington. State Dept. Ecology, Olympia.

A. Johnson, D. Norton, B. Yake, and S. Twiss. 1990. Transboundary Metal Pollution of the Columbia River. Bull. Environ. Contam. Toxicol. 45:703-710.

Art Johnson. 1991. Review of Metals, Bioassay, and Macroinvertebrate Data from Lake Roosevelt Benthic Samples Collected in 1989. Memorandum to C. Nuechterlein. Washington State Dept. Ecology, Olympia.

A. Johnson, D. Serdar, and D. Davis. 1994. Results of 1993 Screening Survey on PCBs and Metals in the Spokane River. WDOE Pub. 94-E24.

Eric Johnson. 1997. Upper Spokane River rainbow trout spawning emergence study for 1995 and 1996. Prepared for the Spokane River Management Team. Washington Water Power.

Joe Joy. 1992. Inland Empire Paper Company Mixing Zone Survey. September 1990. Washington State Dept. Ecology, Olympia.

Todd Kleist. 1987. An evaluation of the fisheries potential of the lower Spokane River: Monroe Street Dam to Nine Mile Falls Dam. Washington Water Power Company and Washington State Department

of wildlife.

Barry Moore, Arden Thornburg, John Schaumloffel, and Royston Filby. 1996. Chironomid deformity rates, metal body burdens, and sediment metal concentrations from the Coeur d'Alene/Spokane River systems. Washington Water Research Center – USDOI.

M. Munn, S. Cox, and C Dean. 1995. Concentrations of Mercury and Other Trace Elements in Walleye. Smallmouth Bass, and Rainbow Trout in Franklin D. Roosevelt Lake and the Upper Columbia River, Washington, 1994. USGS Open-File Rept. 95-195.

Greg Pelletier, 1994. Cadmium, Copper, Mercury, Lead, and Zinc in the Spokane River: Comparisons with Water Quality Standards and Recommendations for Total Maximum Daily Loads. Washington State Dept. Ecology, Olympia. Pup. No. 94-99. *(Spokane R metals study data on Pb, Zn, Cd, Hg, Cond., Alk., Cl, TSS, Hard., K, TOC, Mg, Cu, Nitrate/Nitrite, TDS, Ca, Na, SO_4, Temp., pH).*

Greg Pelletier. 1995. Dissolved Oxygen in the Spokane River Downstream from Inland Empire Paper Company with Recommendations for Waste Load Allocations for Biochemical Oxygen Demand. WDOE Pub 94-155.

Greg Pelletier. 1996. Applying Metals Criteria to Water Quality-Based Discharge Limits, Empirical Models of the Dissolved Fraction of Cadmium, Copper, Lead, and Zinc. WDOE Pub. 96-339

Daniel Pfeiffer. 1985. A general assessment of aquatic resources on the lower Spokane River reservoirs. Washington Water Power.

D. Reif .1986. Kaiser Aluminum & Chemical Corporation Class 11 Inspection, May 6-7, 1986. Memorandum to R. Ray. Washington State Dept. Ecology, Olympia.

J. Saltes and G. Bailey. 1984. Use of Fish Gill and Liver Tissue to Monitor Zinc Pollution. Bull. Environ. Contam. Toxicol. 32:233-237.

D. Serdar, A. Johnson, and D. Davis. 1994. Survey of Chemical Contaminants in Ten Washington Lakes. Washington State Dept. Ecology, Olympia. Pub. No. 94-154.

Margaret Stinson, 1993. Spokane River Metals Water Effects Ratio Study. Memorandum to G. Pelletier. Washington State Dept. Ecology, Olympia.

USGS WATSTORE System. 1998 *(Multiple station analyses of Spokane River water quality).*

Washington State Dept. Ecology. Ambient Monitoring Section Statewide River and Stream Monitoring. *For conventional chemical analyses, and metals at two sites, see http://www.wa.gov/ecology/eils/fw_riv/spokane.html (ultra low level metals detection methods were used from 1994 to 1997).*

W. Wiggins, G. Ruppert, R. Smith, L. Reed, L. Hubbard, and M. Courts. 1996. Water Resources Data, Washington, Water Year 1995. USGS. Data Report WA-95-1.

J. Yearsley. 1980. Water Quality Studies of the Spokane River between Coeur d'Alene, Idaho, and Post Falls, Idaho 1978-79. EPA Region 10. EPA 91019-80-072.

J. Yearsley. 1981 draft. An examination of the nutrient and heavy metals budget the Spokane river between Post Falls and Hangman Creek EPA Region 10.Y.

Zheng. 1995. M.S. Thesis. Eastern Washington University, Cheney WA

Appendix 1

December 13, 1999

WASHINGTON STATE DEPARTMENT OF

Natural Resources

JENNIFER M. BELCHER
Commissioner *of Public Lands*

Matt Kadlec, Ph.D.
Environmental Assessment Program
Department of Ecology
PO Box 47600
Olympia WA 98504-7600

SUBJECT: Spokane River Remedial Investigation / Feasibility Study - Contamination from the Bunker Hill, Idaho Superfund Site

We've searched the Natural Heritage Information System for information on rare plants in the vicinity of the Spokane River. We have enclosed a summary of known locations of rare plant occurrences in your study area, as well as a list of rare plant species that may occur in the river habitats you described. There may be other significant plant species that could occur along the river - the enclosed lists are based on an initial review of available information.

The information provided by the Washington Natural Heritage Program is based solely on existing information in the database. In the absence of field inventories, we cannot state whether or not a given site contains high quality ecosystems or rare species; there may be significant natural features in your study area of which we are not aware. These data are being provided to you for informational and planning purposes only - the Natural Heritage Program has no regulatory authority.

If you have the opportunity, visit our website at http://www.wa.gov/d and click on *Conservation/Protection.* Please do not hesitate to call me at (360) 902-1667 if you have any questions, or by E-mail: sandra.moody@wadnr.gov.

Sincerely,

Sandy Swope Moody, Environmental Coordinator
Washington Natural Heritage Program
PO Box 47016
Olympia WA 98504-7016

Enclosures

1111 WASHINGTON ST SE I PO BOX 47000 1 OLYMPIA, WA 98504-7000
FAX: (360) 902- 7 775 1 TTY: (360) 902-1125 1 TEL: (360) 902- 1000
Equal Opportunity/Affirmative Action Employer

The attached lists were prepared by John Gamon, Washington Natural Heritage Program Department of Natural Resources, transmitted to Matt Kadlec from Sandra Moody (360-902-1667) December 1999.

WASHINGTON NATURAL HERITAGE INFOR14ATION SYSTEM
ENDANGERED, THREATENED AND SENSITIVE PLANTS
IN THE VICINITY OF SPOKANE RIVER
REQUESTED BY DEPARTMENT OF ECOLOGY

Data Current as of December 1999
Page 1 of 2

TOWNSHIP, RANGE AND SECTION	ELEMENT NAME-	STATE STATUS	FEDERAL STATUS
T27N R39E S10	*Carex hystericina* (porcupine sedge)	S	
T27N R39E S14 NE	*Antennaria parvifolia* (Nuttall's pussy-toes)	S	
T27N R39E S14 SW	*Antennaria parvifolia* (Nuttall's pussy-toes)	S	
T27N R39E S14 NEofSE S13 NWofSW	*Hackelia cinerea* (gray stickseed)	S	
T27N R39E S13 S half	*Carex hystericina* (porcupine sedge)	S	
T27N R39E S13 SW S24	*Hackelia cinerea* (gray stickseed)	S	
T27N R39E S24 NE	*Spiranthes porrifolia* (western ladies-tresses)	S	
T27N R39E S24 SE	*Carex hystericina* (porcupine sedge)	S	
T27N R40E S19 W half	*Carex hystericina*	S	

	(porcupine sedge)	
T27N R40E S20 SE S29	*Carex hystericina* (porcupine sedge)	S
T27N R40E S20 E half S21 NW	*Carex hystericina* (porcupine sedge)	S
T27N R40E S21 N half S22 N half	*Carex hystericina* (porcupine sedge)	S
T27N R40E S21 N half S22	*Antennaria parvifolia* (Nuttall's pussy-toes)	S

WASHINGTON NATURAL HERITAGE INFORMATION SYSTEM
ENDANGERED, THREATENED AND SENSITIVE PLANTS
IN THE VICINITY OF SPOKANE RIVER
REQUESTED BY DEPARTMENT OF ECOLOGY

Data Current as of December 1999

TOWNSHIP, RANGE AND SECTION	ELEMENT NAME	STATE STATUS	FEDERAL STATUS
T27N R40E S11 SE S12 SW	*Carex hystericina* (porcupine sedge)	S	
T27N R40E S01 SW	*Hackelia cinerea* (gray stickseed)	S	
T27N R40E S01 E half	*Carex hystericina* (porcupine sedge)	S	
T27N R40E S01 NE	*Antennaria parvifolia* (Nuttall's pussy-toes)	S	
T26N R42E S07 S half S17 NWofNW	*Hackelia cinerea* (gray stickseed)	S	
T26N R42E S28 SE	*Antennaria parvifolia* (Nuttall's pussy-toes)	S	
T25N R42E S02 SW S11 NE	*Cryptantha spiculifera* (Snake River cryptantha)	S	
T25N R42E S15 E half	*Spartina pectinata* (prairie cordgrass)	S	

WASHINGTON NATURAL HERITAGE INFORMATION SYSTEM
Endangered, Threatened, and Sensitive Vascular Plants

Federal Status definitions:

LE = Listed Endangered: Any taxon which is in danger of extinction throughout all or a significant portion of its range and which has been formally listed as such in the Federal Register pursuant to the Federal Endangered Species Act.

LT = Listed Threatened: Any taxon which is likely to become endangered within the foreseeable future throughout all or a significant portion of its range and which has been formally listed as such in the Federal Register pursuant to the Federal Endangered Species Act.

PE = Proposed Endangered: Any taxon which is in danger of extinction throughout all or a significant portion of its range and which has been proposed for listing as such in the Federal Register pursuant to the Federal Endangered Species Act.

PT = Proposed Threatened: Any taxon which is likely to become endangered within the foreseeable future throughout all or a significant portion of its range and which has been proposed for listing as such on the Federal Register pursuant to the Federal Endangered Species Act.

C = Candidate species: Taxa for which current information indicates the probable appropriateness of listing as Endangered or Threatened.

SC = Species of Concern: Species whose conservation standing is of concern but for which status information is still needed. Species of concern lists are not published in the Federal Register.

State Status definitions:

E = Endangered: Any vascular plant taxon in danger of becoming extinct or extirpated from Washington within the foreseeable future if factors contributing to its decline continue. Populations of these taxa are at critically low levels or their habitats have been degraded or depleted to a significant degree.

T = Threatened: Any vascular plant taxon likely to become Endangered in Washington within the foreseeable future if factors contributing to its population decline or habitat degradation or loss continue.

S = Sensitive: Any vascular plant taxon that is vulnerable or declining and could become Endangered or Threatened in the state without active management or removal of threats.

X = Possibly Extinct or Extirpated from Washington: Based on recent field searches a number of plant taxa are considered to be possibly extinct or extirpated from Washington. Taxa in this group are all high priorities for field investigations. If found, they will be assigned one of the above status categories.

R = Review: Taxa of potential concern, but for which no status has yet been assigned. Group 1 = Taxa in need of additional field work before a status can be assigned. Group 2 = Taxa with unresolved taxonomic questions.

W = Watch: Taxa more abundant and/or less threatened in Washington than previously assumed.

Washington Natural Heritage Program
Department of Natural Resources
December 1999

Species Known to Occur Along the Spokane River in Washington State

Antennaria parvifolia	adjacent uplands
Carex hystericina	riparian areas/wetlands/shoreline of impounded lacustrine areas
Cryptantha spiculifera	adjacent uplands (sandy slopes)
Hackelia cinerea	adjacent uplands (exposed basalt)
Oxytropis campestris var. *columbiana*	riparian (cobbly/sandy at river's edge); historically known only
Spartina pectinata	riparian/shoreline of impounded lacustrine areas
Spiranthes porrifolia	adjacent uplands

Additional Species That May Occur Along the Spokane River in Washington State

Carex buxbaumii	wetlands
Carex comosa	riparian areas/wetlands/shoreline of impounded lacustrine areas
Cicuta bulbifera	wetlands/riparian areas/shoreline of impounded lacustrine areas
Epipactis gigantea	riparian areas/wetlands/shoreline of impounded lacustrine areas
Geum rivale	wetlands/riparian areas
Hypericum majus	riparian areas/wetlands/shoreline of impounded lacustrine areas
Impatiens aurella	wetlands/riparian areas
Ribes oxyacanthoides ssp. *irriguum*	riparian/adjacent uplands
Rotala ramosior	riparian areas/wetlands/shoreline of impounded lacustrine areas
Sanicula marilandica	riparian
Tauschia tenuissima	wetlands
Teucrium canadense ssp. *viscidum*	wetlands

Please note: there may other special species that occur along the Spokane River - this list is based on an initial review of information currently available.

Appendix 2

This list was transmitted from Kevin Robinette to Matt Kadlec and John Roland Nov. 16, 1999.

Matt Kadlec, John Roland,

Per you request, I queried our Priority Habitats and Species database for sensitive species and habitats within the vicinity of the Spokane River. They may or may not be affected by contaminants from mining activities in the Coeur d'Alene Basin. The following represents what we know to be in the area and should by no means be interpreted as being all inclusive.

Birds

osprey
bald eagle
Lewis' woodpecker
black-backed woodpecker
Western bluebird
peregrine falcon
golden eagle

Mammals

white-tailed deer
mule deer
moose

Habitats

Spokane River riparian corridor
Nine-mile/Long Lake riparian areas
Devil's Gap bald eagle territory
Knight Lake wetland complex
Miotke Marsh - waterfowl concentration area (breeding waterfowl, American Widgeon, Canada geese, great blue heron, muskrat, other diving ducks)
Little Sandy Canyon - bald eagle wintering area
Painted Rocks - white-tailed deer winter range
Deep Creek - associated streams and ponds
Urban Natural Open Space associated with Riverside State Park
Three Springs Site - mature forest/old growth area at south end of riverside state park
Myrtle point cliff habitat

Please contact me know if I can assist you further.

+-+

Kevin W. Robinette
Habitat Biologist
Priority Habitats and Species Program
Washington Department of Fish and Wildlife
Spokane, Washington
robinkwr@dfw.wa.gov
www.wa.gov/wdfw

Appendix 3

Washington Dept. of Ecology Data on Spokane River Sediment Samples Collected in Oct./Dec. 1998 with Art Horowitz, USGS[1]

Reach →	Upriver		9-Mile	Long Lake					Little Falls	Spokane Arm			Hangman Cr.	Deep Cr.	Littl Spokn	Liberty Lk
USGS Sample ID	SRG-41	SRG-42	SRG-57	SRG-9	SRG-9	SRG-12	SRG-13	SRG-13	SRG-55	SRG-33	SRG-23	SRG-28			SRG-10	SRG-60
WDOE Sample ID	43-8167	43-8168	49-8000	43-8161	43-8161 D	43-8160	43-8159	43-8159 D	43-8001	43-8157	43-8156	43-8155	43-8164	43-8163	43-8162	43-8002
Gravel	0.9	1.4	0.0	0.0		0.0	0.0		0.2	0.0	0.1	2.0	8.8	4.5	0.0	0.0
Sand	93.5	41.7	43.7	86.2		1.5	2.5		71.1	52.6	19.1	37.6	83.3	93.7	49.7	21.9
Silt	5.5	49.4	48.3	12.0		73.5	54.0		26.6	42.4	56.4	27.6	7.1	1.7	41.7	69.7
Clay	0.2	7.4	8.0	1.8		25.1	43.5		2.2	5.0	24.3	32.8	0.8	0.1	8.6	8.4
TOC (%)	0.28	7.8	1.7	1.3		2.3	2.6		1.1	1.6	2.2	1.6	0.53	0.06	3.8	8.3
Zinc (mg/Kg, dry)	807	2,068	427	525	513	939	1,610	1,660	969	630	906	832	44.6	39.3	60.3	85.4
Lead (mg/Kg, dry)	188	305	54.0	39.6	38.2	97.8	198	205	50.2	30.8	90.8	101	8.0	8.6	10.0	45.9
Copper (mg/Kg, dry)	8.7	39.1	20.3	14.0	14.4	31.6	42.0	42.8	17.6	15.3	33.0	29.6	12.0	8.9	9.5	27.4
Chromium (mg/Kg, dry)	11.5	20.4	14.4	12.3	13.0	24.2	28.5	28.8	13.9	16.1	25.3	23.7	10.3	10.8	15.6	21.6
Nickel (mg/Kg, dry)	9.6	15.9	11.8	10.2	11.1	18.4	19.9	20.2	12.0	13.2	20.7	20.9	9.0	9.5	8.7	15.4
Cadmium (mg/Kg, dry)	1.7	17.7	3.1	3.6	3.2	10.7	18.4	18.7	7.0	2.8	5.5	5.3	0.5	0.53	0.5	0.4
Arsenic (mg/Kg, dry)	7.0	9.6	7.6	6.7	6.8	7.2	8.6	9.1	9.3	5.9	10.1	8.6	6.0	7.3	4.4	4.4
Beryllium (mg/Kg, dry)	0.32	0.64	0.63	0.44	0.46	1.0	1.2	1.2	0.51	0.53	1.1	1.1	0.36	0.34	0.74	0.8
Silver (0.3 ~ DL)	0.5	0.76	0.3	0.5	0.5	0.52	1.1	1.1	0.3	0.5	0.5	0.5	0.5	0.5	<0.5	0.3
Selenium (0.3 ~ DL)	0.3	0.32	0.3	0.3	0.3	0.3	0.31	0.3	0.54	0.3	0.36	0.3	0.3	0.3	0.60	0.56
Mercury (0.005 ~ DL)	0.012	0.25	0.026	0.034		0.11	0.25	0.25	0.030	0.032	0.081	0.096	0.0059	0.005	0.027	0.010
% Mort., H. azteca, 14-d	11.3	33.8	7.5	12.5		11.3	11.3		17.5	30.0	11.3	15.7	61.3	30.0	48.8	17.5
EC50 (ppm sed), Microtox	7,641	100000	14,795	59,388	45,140	4,993	3,416		32,431	4,644	5,297	8,983	100000	100000	884	89,401
Zinc (ug/L pore water)	103	92				52	43				226	84			3.7	
Lead (ug/L pore water)	67.5	47.6				13.4	8.9				41.4	12.7			2.1	
Cadmium (ug/L pore wtr)	2.2	1.0				1.40	0.55				4.3	0.75			0.1	

Hardness (mg/L)	210	143		237		122	131				106	132	557	250	334		

Analytical Methodology: All samples come from the upper 2-cm in the grab sampler. All samples were freeze-dried. For all but Hg, 500-mg aliquots were digested with a combination of aqua regia/HF/$HClO_4$ in Teflon beakers at 200 °C. Be, Cr, Cu, Ni, Zn, and Tl were determined by ICP-AES, As, Sb, and Se by hydride generation AAS, and Cd, Ag, and Pb by flame AAS using an atom concentrator tube, mixed salt standards and background correction. Hg was determined on a separately digested 500-mg aliquot using LaFort Aqua Regia at 100 °C in Teflon beakers; quantitation was by cold-vapor AAS. TOC was determined on a 500 mg aliquot after treatment with treatment 10% HCl; quantitation was determined by evolution of CO_2 during combustion in a Leco Carbon Analyzer. A separated aliquot of freeze-dried bulk sample was dry-sieved at 63-gm using plastic meshes (one/sample) in a plastic frame on a shaker table; each sample was sieved for 15 minutes.

1 All USGS analytical data has been validated internally using our own QA/QC procedures. However, it has not been validated by the U.S. EPA.